

EFFECT OF BIOCHAR WITH N P K ON MORPHOLOGICAL PARAMETERS AND BIOCHEMICAL CONSTITUENTS OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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Abstract– A field experiment was done at Naini Agricultural Institute in Research Farm, Department of Soil Science and Agricultural Chemistry, SHUATS, Prayagraj. In the research trial, the experiment was laid in randomized block design with nine treatments and three replications. The okra was planted at a spacing of 30cm×15cm. Growth parameters were collected on plant height (cm), number of leaves per plant, number of fruits per plant, weight of the fruit (g), length of the fruit (cm) and yield of okra fruits (q/ha). The results revealed that the combination of different treatments showed a significant effect on growth and yield parameters with protein and chlorophyll content of okra. Hence, it was concluded that the combination of NPK and Biochar was found to be useful for okra crop in terms of growth and yield parameters under the prevailing conditions of the study area.

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is most popular annual vegetable crop grown in India and Pakistan belonging to the family malvaceae during summer and rainy seasons (Ola *et al.*, 2018). Fresh leaves, buds, pods, stems and seeds are all used in okra, making it a versatile crop. Okra seeds are used for oil production in small scale and okra fruits are also rich in lipids, proteins and fats. When okra is young, the fruits are eaten raw, the oil content of the seed is comparable to that of poultry eggs and soyabean (Adesida *et al.*, 2019). Okra is high in iron and is used to cure gastric ulcers. Vitamins A and C, calcium, thiamine and riboflavin have all been discovered to be abundant. Chlorophyll is the pigment which provides green colour to vegetables such as okra fruits (Khetran *et al.*, 2016).

Fertilizer requirements in okra are critical for the early development and overall fruit yield. Crop productivity can be improved by using organic and inorganic fertilizers. Chemical fertilizers are inorganic fertilizers which are most important to

increase growth and yield of Okra. The use of inorganic fertilizers can increase the nutrient availability and improve the crop yields but its use is limited due to high cost, acidic nature in soil and imbalance of nutrients (Molik *et al.*, 2016).

Biochar is a carbon rich organic material and beneficial as a soil conditioner. It has emerged as an important amendment with fertilizer and holds a key role to improve the yield of crops and has been found to have a great impact on soil fertility and increase in crop yield without causing any hazards. It may increase stabilization of organic matter, nutrient sources in soil and reduces nutrient leaching losses and hence improves nutrient retention. (Farias *et al.*, 2020).

MATERIALS AND METHODS

Study area

The experiment entitled “Effect of Biochar with N P K on morphological parameters and biochemical constituents of Okra (*Abelmoschus esculentus* L.)”

took place at the Sam Higginbottom University of Agriculture, Technology and Sciences, Research Farm of Soil Science and Agricultural Chemistry, Prayagraj, Uttar Pradesh.

Experimental Design

The experiment was divided into 27 plots using a randomised block design (RBD) with nine treatments (three levels of NPK and Biochar 0, 50, 100% dosages) and 3 replications. Each experimental plot was (2m×2m). The levels of NPK applied were 100:60:50 kg ha⁻¹ and biochar 5 t ha⁻¹. The treatments comprises of T₁ (control), T₂ (0% NPK + 50% Biochar), T₃ (0% NPK + 100% Biochar), T₄ (50% NPK + 0% Biochar), T₅ (50% NPK + 50% Biochar), T₆ (50% NPK + 100% Biochar), T₇ (100% NPK + 0% Biochar), T₈ (100% NPK + 50% Biochar), T₉ (100% NPK + 100% Biochar).

In the present study, Okra (*Abelmoschus esculentus* L.) the Yellow vein mosaic virus tolerant variety Syndicate Spl. is seeded to observe the effect of NPK and Biochar on soil physico-chemical properties. ANOVA technique was used to evaluate the data statistically (Fisher, 1960).

Agronomic traits

The data were collected on the growth and yield parameters

1. Plant height (cm)
2. Number of leaves per plant
3. Number of fruits per plant
4. Weight of the fruit (g)
5. Length of the fruit (cm)
6. Yield of okra fruits (q/ha)

RESULTS AND DISCUSSION

The influence of various fertilizer levels on okra growth and yield production was investigated by observing and recording the crop growth, yield and quality parameters of the crop.

Height of the plant (cm)

As depicted in the Table 1, the result explained that the highest plant height was observed 121.36 cm at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest plant height was observed 19.59 cm at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Number of leaves per plant

As depicted in the Table 1, the results explained that

the highest number of leaves was observed 22.72 at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest number of leaves was observed 6.57 at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Number of fruits per plant

As depicted in the Table 1, the result explained that the highest number of fruits was observed 18.42 at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest number of fruits was observed 5.58 at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Weight of the fruit (g)

As depicted in the Table 1, the result explained that the highest weight of the fruit was observed 21.39 at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest weight of the fruit was observed 11.32 at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Length of the fruit (cm)

As depicted in Table 1, the result explained that the highest length of the fruit was observed 15.86 at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest length of the fruit was observed 8.08 at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Yield of the fruits (q/ha)

As depicted in the Table 1, the result explained that the highest yield of fruits was observed 98.64 at 75 DAS for the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and lowest yield of fruits was observed 24.61 at 20 DAS for the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Protein (%)

As depicted in Table 2, there is a significant influence of NPK and Biochar on percent protein content of okra. Protein content was 5.84 shown highest in the treatment T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and 3.12 shown lowest in the treatment T₁[N₀P₀K₀ and Biochar 0 t/ha].

Chlorophyll content (mg/g)

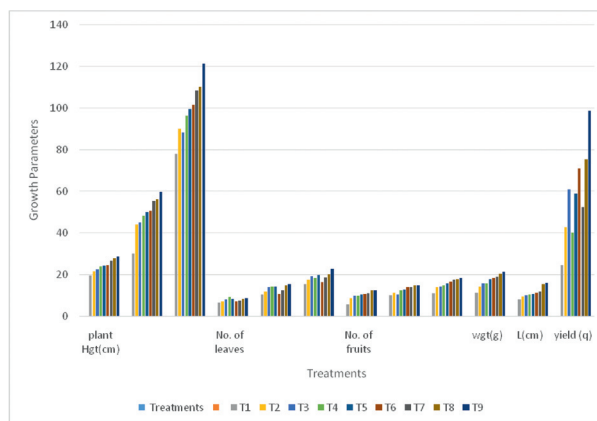
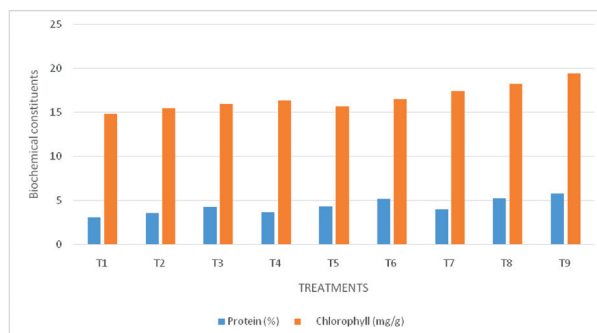
As depicted in Table 2, the highest (19.46) mean chlorophyll content was recorded in T₉[N₁₀₀P₆₀K₅₀ and Biochar 5 t/ha] and the lowest (14.86) mean chlorophyll content was recorded in T₁[N₀P₀K₀ and Biochar 0 t/ha].

Table 1. Effect in growth parameters of okra due to application of NPK and Biochar

Treatments	Plant height (cm)			Number of leaves			Number of fruits			Weight of the fruit (g)	Length of the fruit (cm)	Yield of okra fruits (q/ha)
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	45 DAS	60 DAS	75 DAS			
T ₁	19.59	30.10	78.04	6.57	10.20	15.42	5.58	9.90	10.82	11.32	8.08	24.61
T ₂	21.64	44.08	90.18	7.00	11.92	17.50	8.55	11.31	13.75	14.26	9.46	42.85
T ₃	22.36	44.79	88.39	8.08	13.88	19.22	9.62	10.33	14.32	15.60	9.93	60.74
T ₄	24.06	48.18	96.25	9.20	14.20	18.43	9.68	12.47	14.89	15.79	10.26	40.13
T ₅	24.13	50.01	99.41	8.40	14.21	19.73	10.24	12.72	15.55	17.64	10.65	58.64
T ₆	24.56	50.57	101.70	7.20	10.67	16.36	10.59	13.74	16.66	18.25	11.26	70.81
T ₇	26.68	55.14	108.40	7.47	12.48	18.49	10.82	13.92	17.48	18.91	11.78	52.14
T ₈	27.67	56.12	110.24	8.40	14.84	20.07	12.48	14.82	17.72	20.36	15.33	75.39
T ₉	28.56	59.54	121.36	8.59	15.47	22.72	12.47	14.86	18.42	21.39	15.86	98.64
F test	S	S	S	S	S	S	S	S	S	S	S	S
SEm ±	0.08	0.10	0.15	0.08	0.10	0.11	0.06	0.07	0.10	0.11	0.07	0.06
CD (P=0.05)	0.25	0.29	0.45	0.23	0.30	0.32	0.19	0.22	0.29	0.31	0.20	0.18

Table 2. Effect on Protein and Chlorophyll content of okra due to application of NPK and Biochar

Treatments	Protein (%)	Chlorophyll (mg/g)
T ₁	3.12	14.86
T ₂	3.64	15.48
T ₃	4.28	15.99
T ₄	3.66	16.37
T ₅	4.39	15.72
T ₆	5.18	16.54
T ₇	4.06	17.41
T ₈	5.27	18.23
T ₉	5.84	19.46
F test	NS	S
SEm ±	0.04	0.09
CD (P=0.05)	0.16	0.37

**Fig. 1.** Effect in growth parameters of okra due to application of NPK and Biochar**Fig. 2.** Effect on protein and chlorophyll content of okra due to application of NPK and Biochar

CONCLUSION

According to the findings of the study, incorporating biochar into the soil combined with inorganic fertilizers may be beneficial for enhancing the growth and yield components of okra. Hence, NPK and biochar is recommendable to get the

maximum yield of okra under the prevailing conditions of the study area.

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Conflicts of Interest

T. Poojitha Reddy, confirm that none of the other authors have any conflicts of interest related to this publication.

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